

# Material and Work

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## Abstract

Architecture of the modern period was conceived largely on the basis of the invention of new materials and the upgraded performance of old ones. Opinions differ when we consider the relationship between material and architectural work. For what reason do architects choose certain materials, not others? Why do some architects extremely favor one material over their lifetime, like Mies van der Rohe VS. glass? And what leads to materials' success or failure in architecture?

Most of the classes I'm taking strove to explore the physical potential of material and retrieve the cultural inherent value of materiality. This final project included all the works, during my past 3 semesters, related to the material rethinking and applications. The works included required readings, examinations on certain materials from elective class, as well as material uses in my optional studio design work.

The structure of this project consists of 3 chapters. Each chapter has one themed material, from Wood, Glass to Concrete, including readings, personal thinking and works with certain material.

In "Wood", my focus is on the structural and physical performance of timber system. Wood was considered as a renewable resource that is relevantly easy to process and has good performance in structure, insulation and aesthetics. By researching architectural case in timber, I try to stretch the limits of wood as building material.

In "Glass", I shifted my view from physical to cultural value. Glass was widely used as a paramount transparent material in architecture. The cultural metaphor beyond transparency was considered in the class of "Materiality". And I'm devoting myself into a paper examining how other values of glass, other than its translucent property, were used culturally in architecture.

Finally, more model works were included in "Concrete" part. Concrete was a relevantly controversial material in architecture history. It was considered both old and new, modern and unmodern, natural and unnatural. In my works of casting concrete models, and applying this material in my design work, I tried to have a close touch of concrete and worked with it for better architectural expression.

As conclusion, the 3-semester in AAP offered me deeper understanding of materials and I'm horned to have this final project as the closure of my graduate study, as well as the beginning for my future work.

## Table of Contents

I.	Wood .....	1
II.	Glass.....	8
III.	Concrete.....	16
IV.	Conclusion.....	29

Wood

Wood, for its easy accessibility and adaptability, is viewed as one of the earliest construction materials manipulated by human. But with other new materials emerging in architecture history, wood was once criticized and even discarded in some districts. The usual complain about wood is, lacking of strength, non-fireproof, and rotting. To-day, with highly developed industry and technology, cities cannot afford the overloaded density of population and buildings, which brings about serious pollution and waste of resource. Wood, once recognized as out-of-time, now back to the stage of architecture. The most environment-friendly material, point us another way of rethinking its application in contemporary context.

Inspired by Cidori, a Japanese assembly of wood sticks, Kengo Kuma developed the GC Prostho Museum Research Center<sup>Fig 1</sup>. By using strong cypress wood, the lumber could be sculpted into new shapes while keeping the wooden elements as thin as possible- without requiring the use of bolts, glue or nails for the joins.

In the practice of investigating the GC center in “Rethinking Timber Systems”<sup>1</sup>, we further looked at the specific “Cidori” joints, and their response to the overall structure system. It was composed of a physical model, which aimed at the joints, and a digital work based on Grasshopper and Karamba3D plug-in.

The result demonstrated that the Cidori system has an average force distribution. Different from both fixed joint and hinge joint, Cidori joints display better balance between strength performance and flexibility.



Fig 1: GC Prostho Museum Research Center. Kengo ,Kuma & Associates. Source: [www.archdaily.com](http://www.archdaily.com).2012.

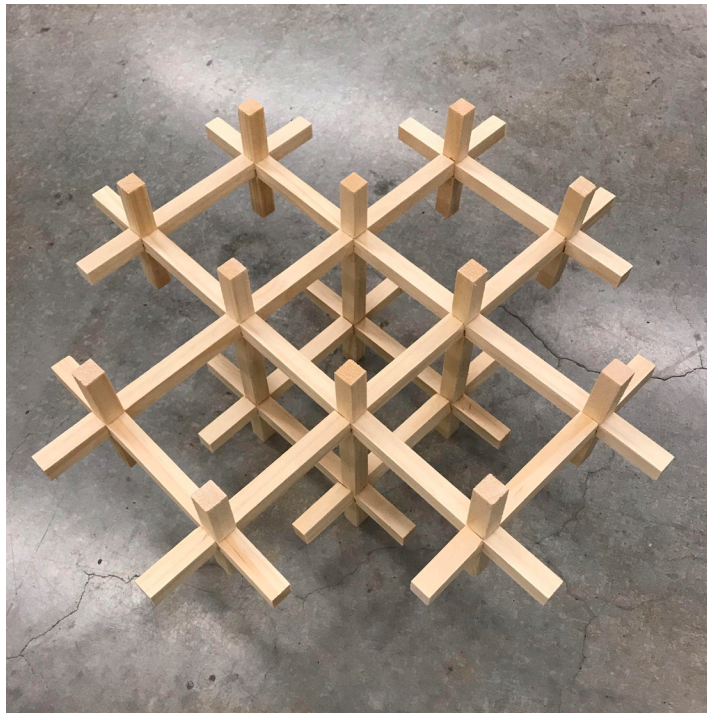


Fig 2: Structure Model of Cidori System. Personal Work. "Rethinking Timber Systems". Instructed by Katharina Kral. Fall 2018-19.



Based on the architectural and structural performance analysis of GC center through physical and digital models, the final assignment challenges us to rethink the timber system at a larger scale. It's a 6 stories office, in which, we mediated the struggling factors between building's mass and structure potential of timber system.

Since the Cidori system has a good performance in previous research, we were positive in its stability at large scale. The idea is from the vault of GC center. In this practice, we focused on the combination of vaults and timber grids. And with the change of this combination, we tried to explore the potential and validity of this structure.

In today's context, current trends and missing frameworks still constrain broader application of timber in dense urban settings. The class of "Rethinking timber systems"<sup>1</sup> broadens my understanding of wood, reconsidering it's not only an environment-friendly material, but also competitive in structure.

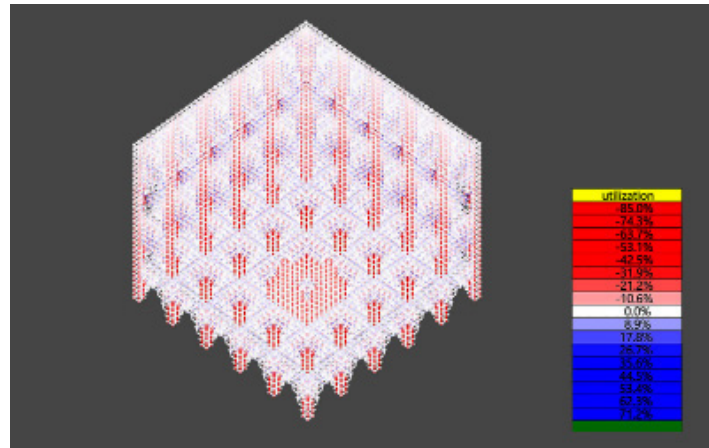


Fig 3: Displacement Analysis of Design Work, Personal Work. "Rethinking Timber Systems".  
Instructed by Katharina Kral. Fall 2018-19.

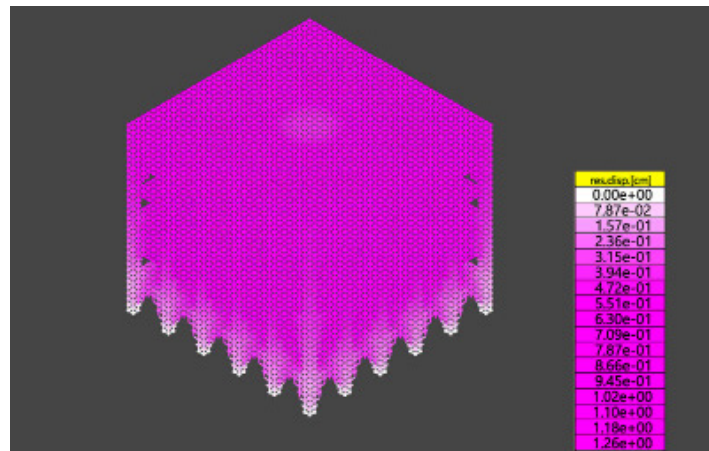
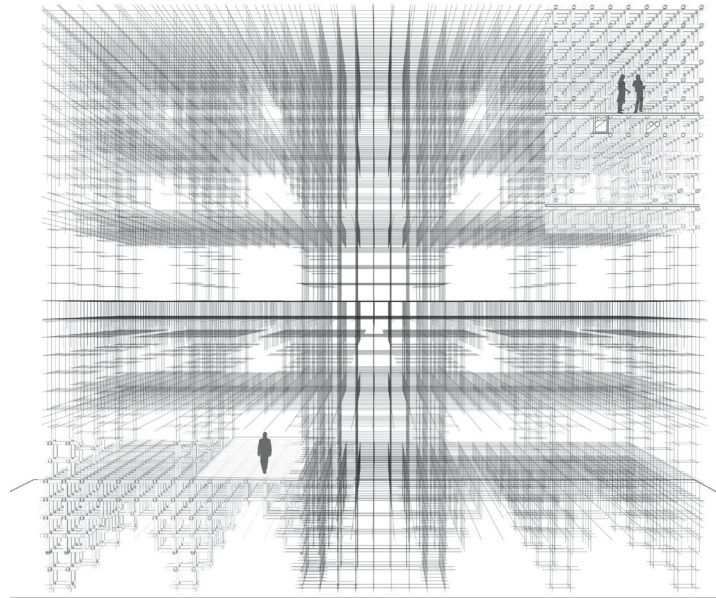


Fig 4: Utilization Analysis of Design Work, Personal Work. "Rethinking Timber Systems". Instructed  
by Katharina Kral. Fall 2018-19.



*Fig 5: Perspective of Design Work, Paterner's work. "Rethinking Timber Systems". Instructed by Katharina Kral. Fall 2018-19.*

Glass

With the renovations in glass-making, its derivative crystalline products are providing us with vivid light effects, which changes the way of our understanding of human and space.

In my paper work of elective class "Materiality"<sup>1</sup>, I'm trying to re-examine other glass types, like stained glass, mirror, and glass blocks, and argued both functionally and culturally, for their significance to architecture history.

The western world is enthusiastically seeking for an earthly heaven from glass metaphor in sacred narratives. In medieval period, glass was revered as the carrier of divine light, and by using stained glass, the faithful was striving to create a place full of sacred colorful light. As the earthly reference to the New Jerusalem<sup>Fig 6</sup>, Gothic Cathedrals were highly sought after, and the “gem” – stained glass windows, which served as the filter between God and man, reached its peak in Middle Ages. Since the Humanism developed in Renaissances, the populace shifted its focus from church to secular life, which dimmed the glory of stained glass.

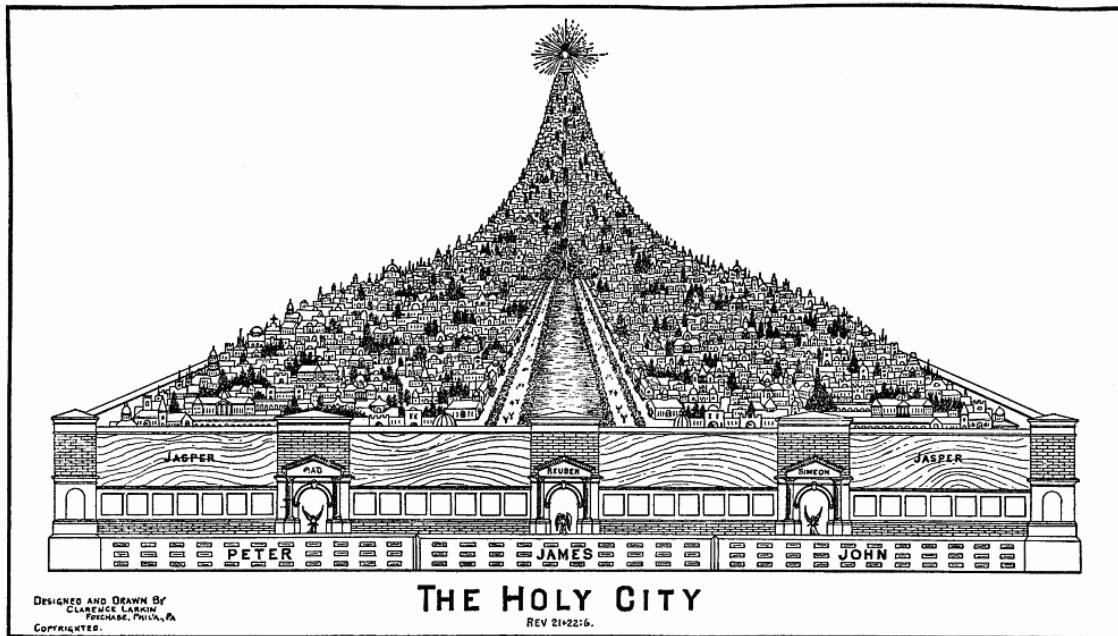


Fig 6: Drawing of the New Jerusalem, Clarence Larkin. Source: [www.patheos.com](http://www.patheos.com). 2015.

While stained glass stands for the way how we are looking outside, mirror, is the tool with which we are exploring inside. The mythology about Narcissus<sup>Fig 7</sup>, and King Solomon's glass floor, reflect the human need to reveal self and truth. Sometimes, the urge for truth would turn into a pursuit for illusion. The Baroque architecture featured in creating infinity, by using mirrors. The Hall of Mirrors is an exemplar to display this trend to its extreme. The overly-decorated interior and extravagantly reflecting space, lured man to believe the king almost was acting as the god.





Fig 7: John William Waterhouse . Echo and Narcissus. 1903. oil on canvas. 109.2 cm x 189.2 cm (42.9 in x 74.4 in). Walker Art Gallery.

Besides the completely clearness of glass, human is looking for some other status between transparent and obscure. It is glass block, which can mediate these two competing factors. Under the influence by the Expressionism during the beginning of 20th century, contemporary architects, like Taut, aimed to create a new world with new materials. The glass pavilion<sup>Fig 8</sup> at the Cologne Deutscher Werkbund Exhibition, is the reflection of his utopia, which symbolized “flowing, graceful, angular, sparkling” qualities.

The glass block façade of the Maison de Verre (1928 -1932) in Paris, is the first try to apply glass blocks to a whole wall of a personal house, which is the revolutionary step forward reinterpreting the relationship between interior and exterior, human and nature.



Fig 8: 1914 "Glass Pavilion" of Bruno Taut. Source: [en. wikipedia.org/wiki/Glass\\_Pavilion](https://en.wikipedia.org/wiki/Glass_Pavilion).

Concrete

“Like language, concrete is a universal medium, found in different forms all over the world, and the problems concrete presents to study are not unlike those of language. Just as with language, it is no good looking at any particular instance unless it can be related to the general condition of the medium: the difficulty, with concrete as with language, is to discover the rules for the general condition.”<sup>1</sup>

Concrete is considered as “massy, stupid”, but has the potential to any shapes.

Concrete is a material, which has been staying with human for centuries, but flourishes in the modern time.

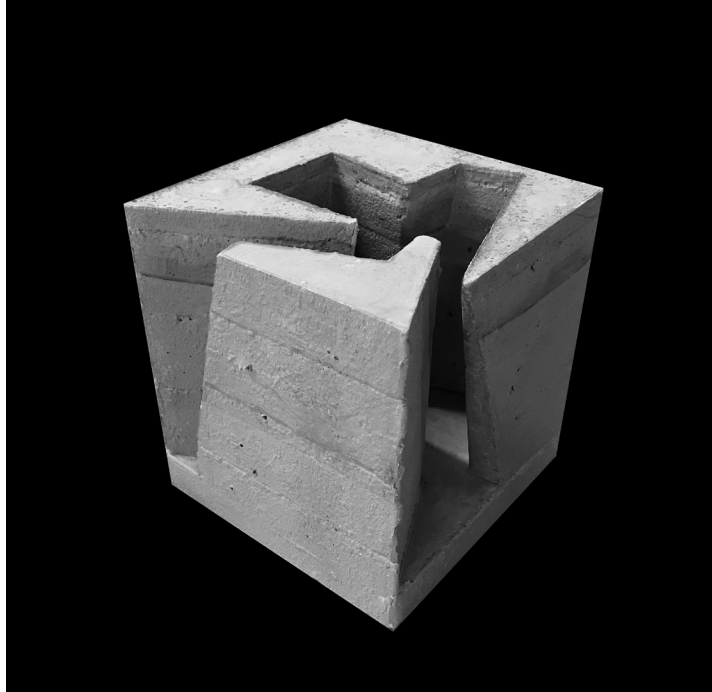
Concrete is a product, whose use relies on theoretically derived principles today, but still roots in the basic manual craft skills.

In the class of “The Detail”<sup>1</sup>, and “In Pursuit of Great Form II”<sup>2</sup>, I was practicing how to cast concrete to realize my design physically. In the beginning, for me, who has never worked with concrete before, it’s almost impossible to manipulate this material. Concrete is tricky, unlike paper, wood, you must experience failures that you have access to the knack. It’s a beast, and it takes patience and time to domesticate.

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<sup>1</sup> “The Detail”. Instructed by Rodolfo Reis Dias. Fall 2018-19.

<sup>2</sup> “In Pursuit of Great Form II”. Instructed by Umberto Bellardi Ricci. Spring 2019.



*Fig 9: Concrete Model of a Desert Pavilion, Personal Work. "The Detail". Instructed by Rodolfo Reis Dias. Fall 2018-19.*

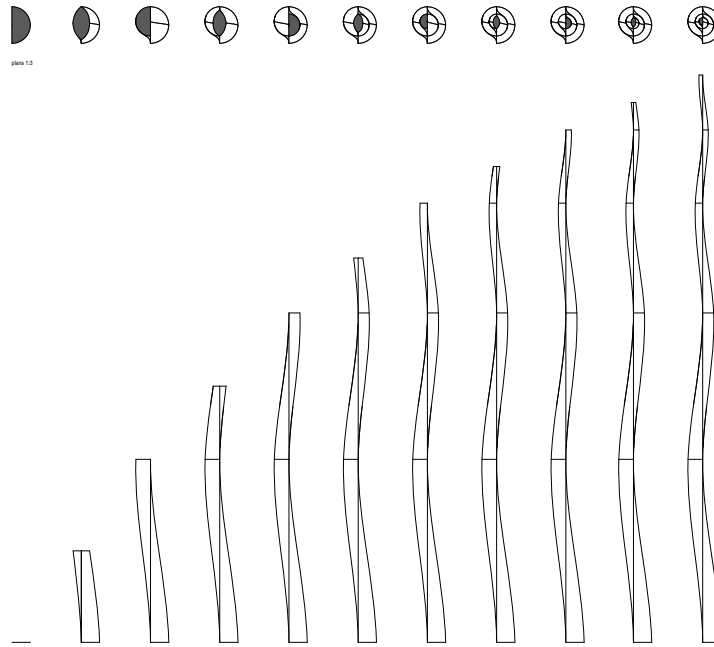


Illustration 1.3  
 Fig 10: Drawing of Concrete Column, Team Work. "In Pursuit of Great Form II". Instructed by Umberto Bellardi Ricci. Spring 2019.



In my option studio work, I chose concrete to be my leading material in my design. First one is from Lisbon Studio<sup>1</sup>. It's a habitation located inside a long stair connecting Castelo de S. Jorge and the viewing tower. I chose concrete as the main material for its cold character, which agreed with the ideal house in my mind, humble and cool. In this relatively enclosed space, the only light is extremely essential here. With different shapes of openings, I try to give each space its own natural light. And the shadow cast on the concrete wall belongs exclusively to this space.



Fig 11: Model Picture. Personal Work. "To Inhabit", Instructed by Manuel Aires Mateus. Option Studio Fall 18.



Fig 12: Model Picture. Personal Work. "To Inhabit". Instructed by Manuel Aires Mateus. Option Studio Fall 18.



Fig 13: Model Picture. Personal Work. "To Inhabit". Instructed by Manuel Aires Mateus. Option Studio Fall 18.



*Fig 14: Model Picture. Personal Work. "To Inhabit". Instructed by Manuel Aires Mateus. Option Studio Fall 18.*

Second one is from Split 3.0 Studio<sup>1</sup>. It's a green park, as well as an outdoor sports space, in Mediterranean district. Choosing concrete, for its reluctance to be defined as "natural" or "unnatural". And the same ambiguity happened in my work, between the exuberant trees and sprawling running tracks, nature and human activities.

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<sup>1</sup> "SPLIT 3.0". Instructed by Sasa Begovic. Option Studio Spring 2019.

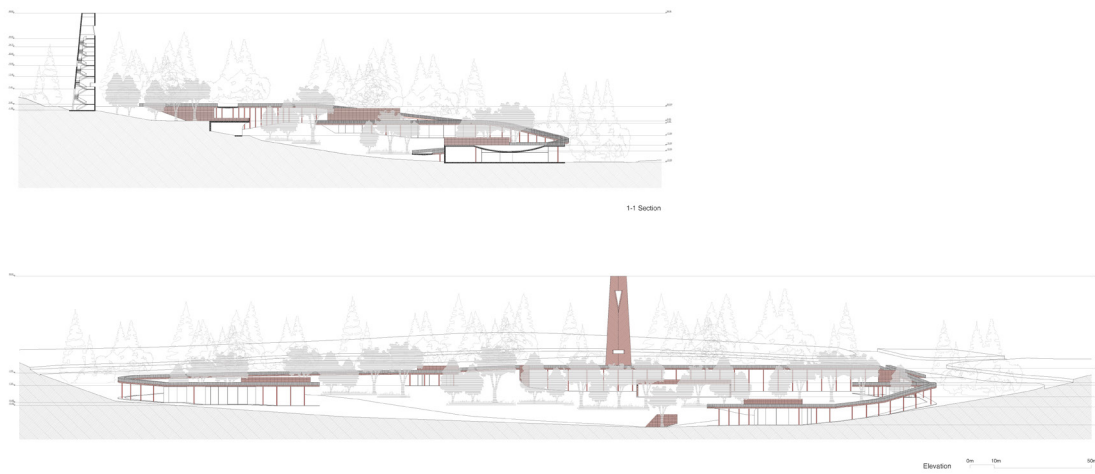


Fig 15: Section and Elevation. Personal Work. "SPLIT 3.0". Instructed by Sasa Begovic. Option Studio Spring 2019.

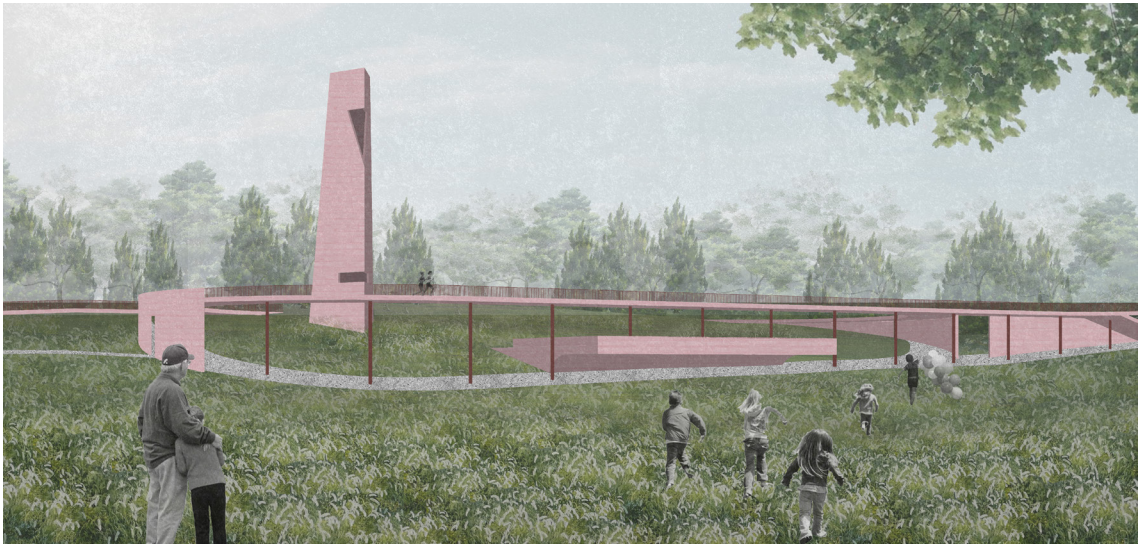


Fig 16: Perspective Drawing. Personal Work. "SPLIT 3.0". Instructed by Sasa Begovic. Option Studio Spring 2019.



## Conclusion

Material, is not merely a tool, manipulate by human being. It has its own character both physically and culturally. And work is not only the manifestation of certain kind of material. Both of them have their own metaphors. In my understanding, only when the happy coincidence happens, which means in specific context, when two of them serve similar symbolism, then the work is there. Like the medieval time's stained glass, with the work of earthly heaven.

Now, I can feel Mies van der Rohe's obsession with glass and steel, and Ando Tadao's persistence in reinforced concrete. It happens only when you dig into the material itself, will you have the profound understanding of the work.

"New materials are born under the sign of imitation: imitation of nature and of preceding materials that have become naturalized over time; they emancipate themselves from an imitative status only when they become the objects of imitation."<sup>1</sup> Maybe in here, the definition of "nature" can expand to "the desirable world in mind". And both of material and work, are the representations of this world.

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